ON ERASION OR ARTHRECTOMY OF THE KNEE JOINT.

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HISTORICAL. In writing this paper our first intention was to give a history of the more recent advances that have been made in the surgery of the joints, in so far as they are related to the operation now called erasion or arthrectomy. But on investigating the question we found so much confusion in the use of the terms which are applied by different writers to operations which, on the one hand are mere sinus scrapings, and on the other practically complete excision, that we abandoned the idea of a history, except in so far as our own work is concerned. This may be given in a few words.

Though removal of the articular extremity of one of the bones entering into the formation of a joint, with more or less complete removal of diseased soft tissues had been performed prior to 1881, we believe that the first really systematic erasion of a joint was done by one of us at the Children's Hospital, Pendlebury, in January, 1881. The case was published in the Lancet for December of that year,[1] but in spite of the excellent result obtained, it does not appear that any other surgeon took up the method. Erasion was, however, systematically practised at the Children's Hospital from that time. In 1882 the matter was brought again before the profession at the British Medical Meeting in Liverpool, and the operation described, and two cases were shown.[1] The technique of the operation as then performed was in all essentials exactly the same as it is now. No record of any similar operation is, however, apparently to be found until 1885, when a paper in the *Medical Chronicle* (by G. A. Wright), giving an account of 16 cases was published: In 1885 Volkmann also wrote a paper describing a practically identical operation, which he called "arthrectomy." His paper will be found in the *Centralblatt f. Chirurgie* for 1885. Both papers were noticed in the Year Book of treatment for that year by Mr. Edmund Owen, and since that time the operation has been gradually gaining ground in spite of the discredit thrown upon it, on the one hand by imperfect and incomplete operations being described as erasions, as well as by its use in unsuitable cases, and on the other hand by misapprehension of the results of the 16 cases published in the *Medical Chronicle.* It is only quite recently that at a meeting of an Irish Medical Society, one of the speakers stated that only one of the 16 cases published was successful; a statement explicable only by supposing either that the speaker had not read the paper, or that his standard of success is considerably higher than that of most surgeons accustomed to deal with tuberculous joint lesions.

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[1] Cases illustrating the Surgery of Childhood, by G. A. Wright, *Lancet*, December 20th, 1881.

While we have no desire to claim for ourselves priority in the performance of erasion unless it fairly belongs to us, we think it is only right that the fact of its introduction as we believe, in England and not in Germany, should be made known and we here gratefully acknowledge the generous approval of the method accorded by Messrs. Edmund Owen, R. W. Parker and others, as well as our appreciation of those who, like Mr. Lediard of Carlisle, have sent us records of their cases.

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[1] The paper then read "On the value of determining the primary lesion in Joint Disease," by G. A. Wright, was published in the *British Medical Journal* for September 1st, 1883.

INDICATIONS. We do, however, earnestly ask the attention of the profession to the following questions:

Whether, after failure of adequate treatment by non-operative means, erasion is not a superior operation in suitable cases to incision, and ought not therefore to replace the more severe operation?

It is of the greatest importance that the performance of the operation shall be, as far as possible, limited to those cases for which experience has shown it to be especially suitable.

It is with tubercular disease of the joints that erasion will always be particularly associated, but we must not be understood to imply that every joint, as soon as proved to be beyond doubt tubercular, is to be at once subjected to operation.

An impression seems to obtain in many quarters that a tubercular joint never recovers even with continuous rest and every palliative endeavor, and that operative treatment itself, short of amputation, is of doubtful utility.

It may be taken as an ascertained fact that the great majority of tubercular joints will recover if properly treated, with complete rest and good hygiene, especially sea-air and nourishing diet. It is begging the question to state, as some do, that the recovery of the joint by rest is merely an indication that the disease was simple in nature, and not tubercular.

If a knee joint, after sustaining some simple injury, has, after the subsidence of the initial trouble, been left weak, painful, limited in movement, with swelling and perhaps some local increase in temperature, and if the condition is persistent and evidently of a tubercular nature, palliative measures, including rest, should be tried.

But in the majority of cases in which, even under this treatment, some abatement of the symptoms does not occur, and especially some diminution of the increased girth of the joint, as shown by accurate periodic measurements, operative interference is called for. It is, of course, difficult to state any exact period of time after the expiration of which palliative treatment may be supposed to have failed; each case must be considered on its merits. Some, owing to the disease evidently extending even under treatment, will call for early interference; others will recover without operation even after being apparently in a stationary condition for many months. In an average case, three months may be looked upon as giving a fair trial to palliative measures; *i. e.*, if the disease is still progressive after this time, operation is called for. Of course we must be quite sure that the trial has been fair, but on the other hand it is extremely important not to delay too long, for it is hopeless to employ this method of operation in joints where the disease is very advanced, and the failures in some, especially of our earlier cases, were undoubtedly due to the operation being performed too late, and after the disease had become very extensive.

Delay is less excusable if there is evidence of caseation taking place in the tubercular joint. For though undoubtedly in some cases with caseation spontaneous cure has taken place, either by cicatrization or calcification, still the probability of recovery of the limb without operation is infinitely lessened by the occurrence of caseation, and in addition, the patient is in a position of greatly increased risk of general tubercular infection, and of suppuration with its dangers from exhaustion and amyloid disease or of relapse. It is extremely important, therefore, to watch for the earliest signs of caseation as indicated by some local doughiness of feel, and perhaps some slight evening pyrexia. But the caseation must be considerable and have gone to commencing liquefaction before it can be diagnosed with certainty by the above means, and often small foci of caseation are found when there has been no indication of their existence except the chronicity and stubbornness of the disease; chronicity in fact may be looked upon as the best and surest indication of caseation.

Moreover, by early operation we have many advantages. Our patient is in a better general condition, and so less likely to suffer from shock and the immediate risks of the operation; we can be more certain of obtaining healing by first intention with its manifold and manifest gains, and the absence of suppuration and sinuses enables us to make our germicide precautions more effective, and so run less chance of either local or general tubercular or septic infection.

As to how far a certain amount of generalized tuberculosis should veto the operation is a moot point; it is customary to advise that evidence, even slight, of such a condition, and that in many cases even a feeble state, although apparently non-tubercular, should prohibit from any interference short of amputation. But in the operation here advised, where, using the later methods, in the majority of cases healing by first intention is obtained, after the initial shock, which is doubtless more severe, the process of repair seems to call for no greater power than that following amputation, and it seems probable that the dictum will either have to be modified or reversed. It must be borne in mind that if the case is really fit for erasion the local disease is as completely removed as by amputation. If with some general tuberculosis present an operation is decided upon and if it is doubtful whether all the disease in the joint can be removed, that is to say, if the case is unsuitable for erasion or for excision with complete removal of the diseased soft tissues, then amputation is the only resort.

Erasion of the knee may be performed in patients of any age, but it is in the young that it will be most practical; we have performed the operation with perfect success in a child under two years of age. In adults the fact that the operation does not arrest development is of little value. The operation is applicable also to those rare cases of chronic synovial disease which, though not tubercular, cause great thickening of the synovial membrane, and resist the most prolonged palliative treatment.

MODE OF OPERATION.—As first performed in 1881, the joint was opened by a semilunar incision below the patella, but more recently all our operations have been transpatellar.[1] An incision slightly convex downward is made from one femoral condyle across the middle of the patella to the other condyle, the skin is dissected upwards and the patella exposed; this bone is then sawn across, or in the case of young children divided with a stout scalpel and the two halves turned upward and downward. To do this, longitudinal incisions are made through the tissues on each side of both halves of the patella, upward as far as the upper limit of the synovial pouch and downward nearly to the anterior tubercle of the tibia. The lateral ligaments are freely divided and the whole of the anterior and lateral parts of the capsule together with the semilunar cartilages and synovial membrane are cut away with scalpel and scissors, taking care to enucleate and dissect out the whole of the upper synovial pouch. All synovial membrane aad pulpy material is removed from the neighborhood of the patella and its ligament. Next the condyles of the femur, crucial ligaments and upper end of the tibia are carefully cleaned, every particle of diseased tissue being cut or scraped away. Next by flexion and rotation of the loosened joint all the diseased synovial membrane and capsule at the back of each condyle and in the inter-condyloid notch, as well as behind and between the crucial ligaments, is completely removed. This is the most difficult part of the operation, but is in most cases possible without division of the crucial ligaments, provided the lateral parts of the capsule have been thoroughly removed. If the crucial ligaments are infiltrated with tubercular material, or if they really prevent complete eradication of the disease, they should be taken away, but it is better to preserve them if possible; they are, however, not essential to a good result. Great care must be taken to thoroughly remove the whole of the semilunar cartilages, and the synovial membrane at the back of the joint, since it is here that diseased material is likely to be overlooked, and here often caseous foci and even localized abscesses are found.

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[1] The transpatellar operation gives free access to the joint cavity, and as the patella readily reunites, there is no fear of loss of extensor power.

After thus dissecting away all the morbid tissue in the soft parts, often leaving the lower end of the femur quite stripped, if the disease has extended beyond the limits of the synovial membrane, the bones must be carefully inspected, and any little pits or doubtful spots in the articular cartilage or on the bony surfaces must be gouged out or scraped away. Still more care, of course, must be taken if any deeper focus of disease in the bone is laid bare by removal of the softer tissues. All morbid material must be taken away, but no healthy bone sacrificed. Since, as a rule, tubercular disease of the knee is primarily and principally synovial, the bone lesions in cases in which the possibility of erasion can be seriously considered will be found for the most part superficial and local. In some cases we employ the actual cautery (Paquelin) to sear any doubtful spots, but it is far better to cut wide of them.

After making quite sure that all disease is removed the joint is well douched with sublimate lotion, any visible vessels are ligatured and then the Esmarch's tourniquet is taken off, and arrest of the principal bleeding points secured.[1] A mixture of equal parts of powdered iodoform and boracic acid is then well dusted over and rubbed into the surface and all recesses of the wound, the patella is sutured by catgut sutures carried through or around the two halves. Drainage is then provided for by forcing a blunt raspatory through the tissues at the back of the joint on each side of the limb, and cutting down upon it through the skin. A tube is passed through such aperture, and the front wound is then sewn up. After dusting the wounds with the iodoform and boracic powder, a double layer of wet gauze is laid over the incisions and the whole knee packed thickly with wood wool wadding, of which a dressing some 3 or 4 inches thick, at least, should be used. This is firmly bandaged on and the limb fixed upon a bracketed back splint with a foot piece.

Such is the ordinary mode of operating that we have employed. On two or three recent occasions, however, we have dispensed with all drainage, applied the dressings with firm pressure without securing any vessels beforehand, and have not taken off the Esmarch bandage until the dressings have been applied. This mode of dressing was, we believe, first employed by Messrs. Barker and Pollard of University College Hospital, and in its simplicity and expedition, is an improvement. It answered perfectly in our cases, and with one exception no ill result even threatened. Care must of course be taken to have the pressure so adjusted that on the one hand no bleeding takes place, and on the other that the vitality of the limb is not endangered. This end is best obtained by using a great thickness of the wood wool wadding and bandaging very firmly.

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[1] The cautery is useful sometimes as a hæmostatic.

Cases that do well need not be dressed for a fortnight; if a little discharge is seen coming through, the dressing should be soaked with sublimate lotion 1-3000, and some more wool bandaged firmly on. If drainage tubes have been used, they should be removed at the first dressing. In any case it is well at the end of a fortnight to dress and fix the limb in a metal splint with plaster-of-Paris as shown in the figure (p. 417). The firm pressure not only prevents bleeding, but squeezes out any fluid in the interstices of the wound and prevents re-collection there and also keeps the raw surfaces in perfect apposition, so that primary union takes place throughout the entire wound.

WHAT IS ERASION?—There seem to be very conflicting ideas as to what we are exactly to understand by the terms arthrectomy and erasion.

Many apply the word erasion and even arthrectomy to operations which consist merely in the laying open of sinuses and scraping more or less in the dark with a Volkmann's spoon. Again the same words are used in a wide sense to include on the one hand operations where the main feature has been the removal of large portions of bone, provided the bone was diseased, and without interference with the synovial membrane which might be healthy, and, on the other hand those operations in which the diseased synovial membrane was the only or principal structure removed. In such terminology the word arthrectomy is used whenever only diseased structures, whatever their nature, are taken away as contra-distinguished from the old excision where bone was removed, whether healthy or not, and the synovial membrane left whether diseased or not. The operation thus understood has, therefore, been said to be applicable to all cases of tubercular joint disease, whether of synovial or osseous origin, provided the operation is done early. But it seems preferable, in order that the term, when used, may give us a definite idea of what has taken place, that it should be limited to the use of cases in which the synovial membrane, or in addition the ligaments, are alone diseased and alone removed, or if the bone or cartilage is affected and removed, this shall only occur to a slight and subsidiary extent.

If is clear, then, that erasion is only applicable to those joints in which the disease is mainly synovial, and only to those cases in which the morbid action is so limited.[1] Hence its main application is, we think, to the knee joint, in which of all others, synovial disease, pure and simple, is most often met with. Erasion may probably be occasionally employed successfully in the case of the shoulder and elbow; we have had a successful case of erasion of the ankle; in the hip and wrist it will probably never be applicable, since in the former the disease is nearly osteal and all diseased tissue cannot be removed, and in the latter the extension of the michief around the carpal bones necessitates their removal, and thus the operation becomes an excision rather than erasion. In the ankle, as a rule, the astragalus requires removal, and the spread of the disease into or between the tibia and fibula, and its origin in the interior of the tibia as well as its frequent extension downward to the os calcis and astragalo-scaphoid joint,prevent us from recommending erasion in this articulation.

The special advantages of the operation are numerous, and partly arise from the nature of the operation itself and partly from its method of performance as here recommended. There is no shortening, since even if small portions of bone are removed there is no routine removal of apposed surfaces. There is, moreover, no deformity; after recovery the contour of the joint is normal, simply showing the cicatrix at the line of incision.

But what is of far greater importance in such a joint as the knee in children, is that there is no arrest of growth, the epiphyseal lines not being interfered with. The greatness of this advantage is very evident when we remember that the increase in length of the femur takes place mainly at the junction of the diaphysis with the lower epiphysis and in the tibia at its upper epiphyseal line. It has been stated as a point against the operation that the surfaces left do not fit as exactly as if sawn off in excision, but surely the normal shape is the best if we are careful that position is maintained during healing, and this can be readily done without either wiring or pegging the bones together.

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[1] Our experience is that the great majority of cases of tuberculosis of the knee are primarily synovial, and not as some surgeons state, osseous.

Again, free movement in the joint has resulted, though, judging from our present experience, this is not to be aimed at nor actively tried for, but allowed to result from the patient's own use, as suggested by Mr. Edmund Owen, after the limb has been kept fixed for the required time. It is very possible that free movement may be obtained more frequently, and with greater safety, when our experience of the after-results of the operation is greater than at present.

But there are other benefits which are obtained by an improved antisepticity with its rapid healing, for we lessen considerably the danger of causing a general tubercular infection at the time of operation, or of causing some fresh local tubercular focus by inoculating tissue previously healthy, both of which accidents have doubtless often occurred. The risk of septic infection or of exhaustion and amyloid disease from prolonged suppuration is also reduced.

Again recovery is, in the majority of our later cases, so rapid that the freedom from pain with the possibility of outdoor exercise on crutches, with good food and hygiene, speedily improves the general health.

The causes of failure of the operation are in our opinion the following, and their importance is we think in the order they are mentioned.

1. Incomplete removal of the disease.
2. Failure in maintaining asepsis.
3. Inability of the patient to repair the wound left by the operation.

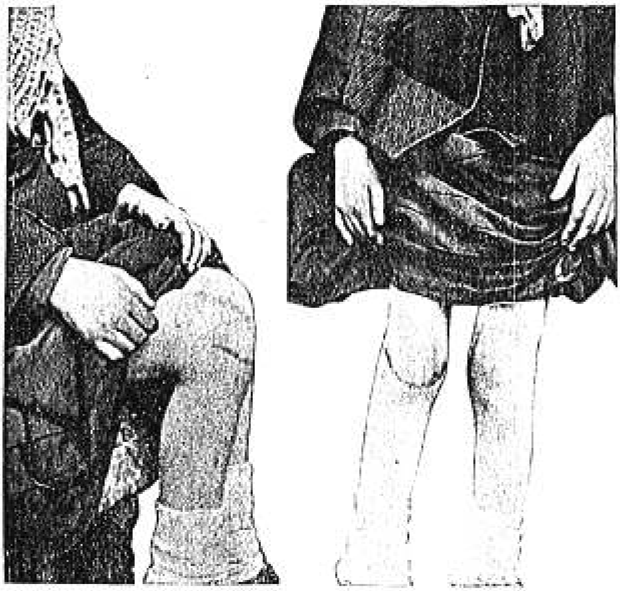
We desire to protest strongly against the practice of calling any and every incomplete and mongrel operation upon any joint an erasion or arthrectomy, both because we consider many of these operations are bad surgery, and because they bring discredit upon the operation we have introduced. Erasion is a perfectly definite procedure, having perfectly definite objects and is applicable under well defined conditions, and it is most improper to use the rm for any process other than that described. If any disease dtissue is left behind, the morbid process will spread from it, or at least may do so, the operation will very probably fail, and can only be expected to fail. We do not say that recurrence cannot take place if all the disease is removed. There is no reason why in a tuberculous subject an outbreak of the disease should not take place in the necessarily damaged tissue of an erased knee, as well as elsewhere.

Failure in asepsis is especially fatal to a good result in these operations, probably owing to the complexity of the wound, hence it is of the utmost importance, if sinuses exist at the time of operation, to freely excise them, cutting round and removing all the material adjacent to the sinus, a proceeding preferable, when practicable, to mere scooping them out.

The third cause of failure need not be dilated upon; it is merely that common to all operations, whether conservative or radical; all that can be said is that a clean erasion wound managed so as to give a chance of healing by primary union, is not more likely to severely test a patient's powers of repair than an amputation, and far less than an excision where morbid material is left behind.

It must, however, be remembered that after erasion, as after excision, prolonged care is required; even though the part be perfectly sound, to prevent the occurrence of flexion. It is absolutely essential to keep some rigid apparatus on for two, three or four years after the operation, or deformity will occur. We have had to ultimately amputate in one of our cases in which the erasion was perfectly successful, simply because the friends neglected the child and repeatedly allowed the knee to become flexed. Plaster-of-Paris, leather or poroplastic splints, or a Thomas' knee splint will be found useful appliances, the last especially allows the patient speedily to be up and about after the operation. We do not think that this liability to flexion can be justly considered any objection to the operation since it is no less true of excision, and does not occur when reasonable care is taken of the limb.

As to our results in the 37 cases here recorded, we prefer the cases to be considered individually. We do not conceal from ourselves that we have had many failures, but we consider that the record shows that the operation is feasible, that it is applicable to the knee joint in certain cases, that it is not specially dangerous to life, that it gives, when successful, a better limb than any other operation, and that, as shown by observation of cases for $8^1/_2$ and nearly 8 years respectively, the good results are permanent.



Figs. 1 and 2.—Result $8^1/_2$ Years after Erasion of the Knee-Joint. Case 1.

Cases.

The following brief abstracts give an account of all the cases of erasion of the knee joint performed by either of us, from the date of the first operation in January, 1881, to the present time, July, 1889. The first 16 cases have already been recorded in the *Medical Chronicle* for 1885, but the present condition of some of the patients is now given. Our operations have been performed at the Royal Infirmary, and at the Children's Hospital, Manchester.

CASE 1.—*Erasion. Recovery With Mobile Joint.* Lizzie N., æt. 13 years, 9 months; Old pulpy disease. Erasion, January 22, 1881. A largish patch of carious bone was gouged from the tibia, and a good deal of articular cartilage scooped away. Healed up at once.

Result. A perfectly movable painless joint used freely, and as strong as the other.

Examined July 15, 1889, *i. e.*, 8½ years after operation. The condition of the joint is as mentioned. The patient is now a married woman, does her own housework, walks without any lameness and the knee is literally like the other except for the presence of the scar and slight crackling in the joint.

Figs. 1 and 2 showing a sound mobile limb.

CASE 2.—*Erasion. Recovery With Firm Stiff Leg.* Kate S., æt. 10 years. Pulpy knee of 12 months' duration, following scarlet fever. Erasion, August 11, 1881. A small spot of bone gouged away.

Examined July 15, 1889, *i. e.*, nearly 8 years after operation. The knee is sound and well. It is quite stiff. There is no obvious shortening, and no lameness except such as arises from the stiffness. There is slight genu-valgum and very slight flexion. The girl is strong and well. She wears no apparatus.

CASE 3.—*Erasion. Excision.* Sophia R., æt. 4 years. Pulpy knee of 2 years' standing, partial backward dislocation, sero-purulent fluid in the joint. Erasion April 1, 1881. Did not do well and was excised three and a half months later. Ultimate result, after a long time, a good, sound lyhealed limb.

CASE 4.—*Erasion. Amputation.* George H , æt. 10 years. Pulpy disease of 16 weeks' standing, suppuration in joint, much pulpy disease. Erasion, 1881. Failure, amputation five days later.

CASE 5.—*Erasion. Death From Phthisis 1¾ Years Later.* Florence C., æt. 4 years. Disease of 14 months' standing. Erasion April 1, 1881. The knee healed to a sinus but never completely. She developed spinal caries and died of phthisis February, 1883.

CASE 6.—*Erasion. Recovery.* Benjamin C., æt. 5¼ years. Disease of one year's standing. Erasion June 8, 1882. Some backward dislocation at time of operation. Did well but slowly. February, 1883, the knee is sound and well, but there is some flexion. He walks well. There is still a tendency to flexion, but this is counterbalanced by the existence of ½ inch of actual lengthening.

CASE 7.—*Erasion. Excision. Amputation.* Edmund L., æt. 5¾ years. Disease of 2 years' duration. Erasion June 15, 1882. There was a large cavity running for 2 inches up the femur, and containing caseous bone. The wound healed to a sinus, but after subsequent excision performed only in consequence of a refusal of permission for amputation, the limb was removed in October, 1882.

CASE 8.—*Erasion. Excision. Amputation.* Edward L., æt. 4½ years. Erasion February 2, 1882. A small abscess on outer side of joint. Had had pneumonia before operation, and the lungs were not sound at the time of erasion. Excision in April and amputation in October, 1882.

CASE 9.—*Erasion. Death From Scarlet Fever.* Gertrude C., æt. 5 years. Disease of 11 months' standing. Erasion May 25, 1883. June 1 was nearly healed, so passive movement was attempted; this set up fresh mischief. In July she was sent out with the wound superficial and no swelling, but she contracted scarlet fever, and died of nephritis soon after leaving the hospital.

CASE 10.—*Erasion. Excision. Amputation.* Theresa W., æt. 4 years 11 months. Disease of 2 years' duration. Erasion June 14 1883. No good result. Excision and subsequently amputation in March, 1884.

CASE 11.—*Erasion. Recovery.* Florence N., æt. 4 years. Disease of 7 months' standing. Erasion February 21, 1884. Good result. December 21, 1886, was sound and well, but flexed. She walked well.

CASE 12.—*Erasion. Recovery.* Herbert N., æt. 8¾ years. Disease of 9 months' duration. Erasion January 18, 1884. An abscess on outer side of joint. May, 1885, sound and well, no shortening.

CASE 13.—*Erasion. Recovery.* Kate McG., æt. 5 years. Disease of 8 months' duration. Erasion December 4, 1884 Two small abscess cavities, and at one spot perforation of cartilage. May, 1885, not quite healed but promises well. February, 1886, sound and well, almost straight, a little lengthening of the limb. Is fat and well.

CASE 14.—*Erasion. Recovery. Subsequent Neglect. Amputation.* John C., æt. 3½ years. Disease of over 10 months' duration. Erasion January 23, 1885. Was so grossly neglected after discharge from hospital that he had no chance, and was amputated August 12, 1886.

CASE 15.—*Erasion. Recovery.* Herbert H., æt. 6½ years. Disease of 6 weeks' standing. Erasion April 23, 1885. Acute tubercular synovitis. There was much pulpy disease, but no suppuration at the time of operation. Healed under one dressing. Examined July 15, 1889. Sound and well. No pain or trouble. Stiff, almost perfectly straight. Can walk 4 miles on it, wears no apparatus. There appears to be just sufficient lengthening to neutralize the slight existing flexion.

CASE 16.—*Erasion. Excision.* Charles H.. æt. 6 years. Disease of 9 months' duration. Abscess at back of inner condyle. Cartilages deeply eroded. Did well for a time, but afterwards lost ground, and was excised November 16, 1884. April; 1885, sound and well.

CASE 17.—*Erasion. Amputation.* James H., æt 3 years. Admitted November 24, 1885. History good; was well until he had measles in February; during the attack the knee became swollen and painful, and has never been well since. On admission, advanced pulpy disease with two sinuses. December 5, transpatellar erasion, much pulpy tissue removed; a large cavity in the outer condyle of the femur was found containing four sequestra; no repair took place at first, and about the middle of January the boy's general condition began to fail. On January 29, the knee was explored, and it was found that the disease extended so far beyond the epiphyseal line of the femur that excision gave no prospect of a useful limb; amputation was performed, and, though the healing was delayed by some sloughing of the skin margins, he rapidly improved, and was sent out on March 1 with the wound almost healed; the stump was, however, somewhat conical; the case was, no doubt, unfit for anything but amputation from the first, since the destructionof the lower end of the femur prevented any prospect of a useful limb.

CASE 18.—*Erasion. Recovery.* Wm. W., æt. 3 years. Admitted February 16, 1886. Tubercular history, injured knee at three months old, swelling followed, an opening was made by doctor at home, and the knee got better; a fortnight ago, pain and swelling recurred. On admission, delicate looking child, left knee flexed almost to right angle, with swelling and pain. March 11, transpatellar erasion; there was some pus at the back of the outer condyle, cartilage over inner tuberosity of tibia ulcerated, much pulpy tissue; child got diphtheria on 23rd, and the wound opened up a good deal; he struggled through the diphtheria and then improved, and by June 3rd was able to go home with the wound almost healed, axcept one sinus. November, 1888, sound and well, but has been allowed to become flexed. January, 1889, has been nearly straightened and sent to sea-side. July, 1889, the knee is quite sound, but he is grossly neglected at home, and the union is not yet firm enough to prevent flexion. (Fig. 3.)

CASE 19.—*Erasion. Recovery.* Arthur C., æt. 4 years. Was in hospital July, 1885. Readmitted December 9. Has been fixed in plaster of Paris since last discharge; general condition not improving, marked tubercular synovitis with some pain; was put up in plaster of Paris, and sent out January 19, 1886. Readmitted February 1 with more pain and swelling; a Thomas' splint was applied, and he was able to go home again on the 10th. Readmitted May 10 as disease was progressing. 13th, erasion transpatellar, three small cheesy foci were found, cartilage much destroyed, and a carious focus in bone in outer condyle. 14th, put up in Paul's splint with plaster of Paris. June 2 sent home almost healed. October, 1888, all sound. A little flexion. Some lengthening. July, 1889. Keeps well.

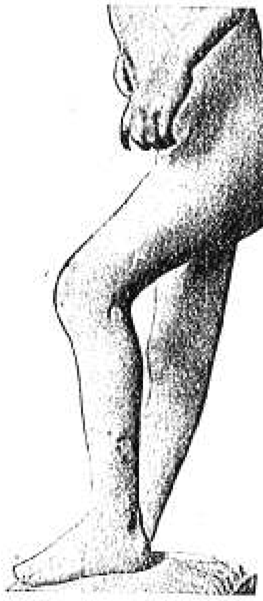


FIG. 3.—SHOWING AMOUNT OF FLEXION IN HEALED LIMB OF CASE 18. (SUBSEQUENTLY STRAIGHTENED.)

CASE 20.—*Erasion. Recovery.* Robert D., æt. 14¾ years. Admitted July 10, 1886. Poor history, duration of disease nine months, (?) injury. On admission, delicate boy, left knee pulpy with periarticular abscess. 22nd, abscess opened, no improvement followed. November 4, erasion, transpatellar, actual cautery applied, bones healthy, much collapse, and next day he was very sick. On 20th he had erysipelas, but subsequently did well, and was discharged in a Thomas' splint on December 7.

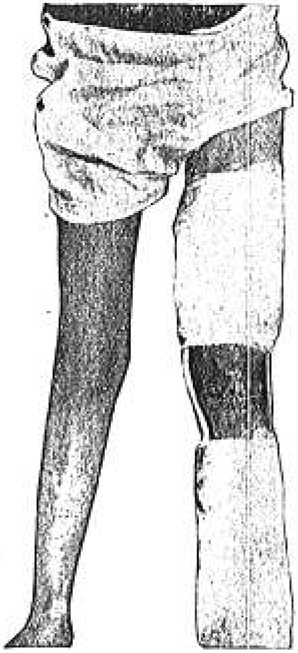


FIG. 4.—SHOWING METHOD OF FIXING LIMB BY PLASTER OF PARIS BANDAGES AFTER ERASION OF THE KNEE-JOINT. (From case 23).

Examined July 15, 1889. All sound and well. He wears a short Thomas' splint still as a precaution as he works in a shop where he is liable to catch his feet in chains, etc., lying on the ground.

CASE 21.—*Erasion. Excision.* John B., æt. 5¼ years. Admitted July 19, 1886. Tubercular history; injury to left knee eighteen months ago. On admission, knee flexed, swollen and tender. Twentyninth, knee straightened under anæsthetic; joint subluxated. August 12, transpatellar erasion; a sequestrum removed from inner condyle; limb could not be fully straightened. Thirteenth, extension applied; there was difficulty in getting the limb straight. Sixteenth, the limb was fixed in a Paul's splint. October 20, sent out in a Thomas splint with wound still unhealed, but doing fairly. Subsequently, March 3, 1887, the knee required excision. He did well and was seen July 15, 1889. The limb is sound and well. He walks well, but there is 1¾ inch shortening. There is slight flexion. It is interesting to note the measurement in this case compared with the result of erasion.

CASE 22.—*Erasion. Incomplete* (recent). Ernest H., æt. 5 years. Admitted May 22, 1889. Disease of five or six months duration. May 29, erasion of right knee. Disease extensive, but entirely synovial. Wound closed entirely and dressed before removal of Esmarch's bandage. June 14, first dressing. Wound healed except at outer angle where there is a gap due to removal of skin at site of superficial abscess. July 15, 1889, wound all sound except a small superficial granulating spot on outer side. Goes to seaside this week. August 20, wound not quite sound yet.

CASE 23.—*Erasion. Recovery.* Sarah Ann C., æt. 10 years. Disease of 4½ years' duration. Has worn Thomas' splint for three years. March 14, 1889, erasion of left knee. Caseous focus in tibia. One drainage tube used. Twenty-second, tube removed. She was sent out quite sound May 14, and continued so July 1889.

CASE 24.—*Erasion. Recovery.* William N., æt. 8 years. Disease of eleven months' duration. May 20, 1887, erasion. A large abscess on the inner side of the joint. Operation tedious and badly borne. Did well but slowly, and was discharged July 10, almost healed. April 10, 1889, readmitted with a local abscess on the inner side of the knee which had never completely healed. This abscess was cleared out and the pulpy tissue excised, and he was sent out May 15, 1889, nearly well. July 16, 1889, he has just returned from the seaside, fat and strong. The knee healed beneath a small superficial scab.

CASE 25.—*Erasion. Recovery.* Mary Ann S., æt. 11 years. Disease of unknown duration. Admitted April 25, 1888. Transpatellar erasion May 3. A vertical incision carried upward from the transverse one to enable the upper synovial pouch to be more readily removed. Some breaking down, caseous material; advanced disease. Was dressed three times up to her discharge May 19. She was readmitted six weeks later for the re-application of the plaster of Paris. She is now, July, 1889, quite sound and goes about in a Thomas' splint. There is slight flexion, (note fig. 5).

CASE 26.—*Erasion. Recovery* (recent). Mary Elizabeth Y., æt. 16 years. Pulpy knee of two years duration. June 8, 1889, erasion of right knee. Transpatellar operation. Crucial ligaments divided. No vessels tied. No drainage. Wound dressed before Esmarch's bandage was removed. Was dressed twice. Primary union throughout except at ends of incision. No suppuration. Sent to Convalescent Hospital. August, 1889, perfectly sound and well.

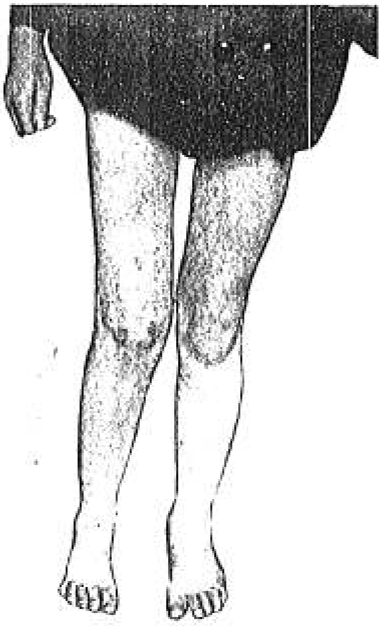


FIG. 5.—RESULT OBTAINED IN CASE 25.

CASE 27.—*Erasion. Amputation.* Hannah N., æt. 26 years. The right knee has never been sound since a fall when she was four years old. It has been worse since a fresh injury three months ago. Admitted August 13, 1888, with pulpy disease and subluxation of the joint. August 18, erasion. Transpatellar operation. In order to straighten the limb it was necessary to remove part of the outer condyle of the femur and outer tuberosity of the tibia. Drainage at the back of the joint. She did not do well. Was very slow in healing and gaining strength, and parts of the patella became exposed and necrosed. There was considerable suppuration, necessitating incisions. It was not till December 22 that she was able to go to the Convalescent Hospital with the wounds almost healed.

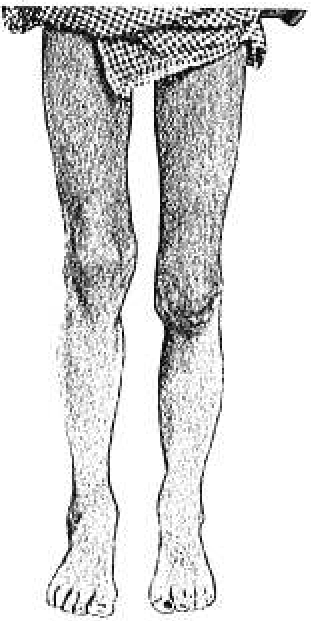


FIG. 6.—RESULT OBTAINED IN CASE 28.

She was not again seen, but it appears that the knee became worse after her return home, and the limb was amputated at her own home in June, 1889

CASE 28.—*Erasion. Recovery.* William B., æt. 7 years. Admitted October 11, 1887. Disease commenced fourteen months previously. On admission fusiform swelling of left knee, semi-fluctuant at sides and above patella; great pain, especially on inner side. As swelling still increased under palliative treatment, operation December 15, 1887. Intra-patellar operation. All pulpy material removed; diseased focus on internal condyle and corresponding part of patella gouged away. Drainage tubes used; fixed in Howse's splint, plastered at first dressing. Slight suppuration during second week. Healed by January 29. Seen July 13, 1889. Contrary to advice has discarded knee Thomas', and walks without any support. No trace of disease in joint, but very slight flexion (vide fig. 6), the flexion giving an appearance of shortening in the figure. No movement.

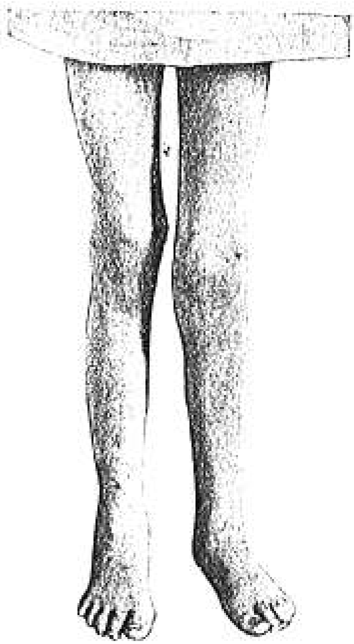


FIG. 7.—RESULT OBTAINED IN CASE 29.

CASE 29.—*Earsion. Recovery.* Eliza A. T., æt. 8 years. Admitted December 13, 1889. Swelling of left knee noticed several months ago; joint enlarged more on inner side and above patella; painful, cannot be fully extended. Scars from old abscesses in neck. As rest had been fairly tried, operation December 22. Incision below patella; large amount of pulpy material removed, especially from pouch below vasti which required vertical incision on inner side to thoroughly clear. Numerous small foci of caseation. Drainage tubes at angles of incision, and one through popliteal space. Fixed on Howse's splint with plaster of Paris. Slow in healing, some suppuration which gradually lessened; left hospital with joint soundly healed, in a Thomas' splint, April 14. Readmitted October 5, 1888, with sinus leading to small lamina of necrosed bone near middle of anterior border of right tibia. Dead bone removed; sinus rapidly closed. Seen July 13, 1889. Joint sound and well, slightly flexed, but slight eversion of foot. (vide fig. 7).

CASE 30.—*Erasion. Recovery.* Thomas F. æt. 5 years. Admitted January 17, 1888, with tubercular left knee. Injury to knee when 6 months old; swelling and inability to walk 18 months ago; swelling most marked on inner side; intense pain; rest and extension; no improvement. Operation March 1. Pulpy synovial membrane removed. Anterior crucial ligament found infiltrated, so removed posterior left, but pulpy pouch behind it cleared. Paquelin cautery applied to slight extent. Draining through popliteal space. Healed by first intention. On March 21st, as some subluxation, plaster removed. Deformity corrected under chloroform, and plaster reapplied. Left with sound joint in knee, Thomas, May 1, 1888. Returned July, 1889, with joint considerably flexed; has been running about for last 6 months without any support. Flexion now being gradually overcome by extension apparatus.

CASE 31.—*Erasion. Recovery.* Tom H , æt. 3 years. Admitted June 23d, 1888, with tubercular arthritis of left knee. Swelling noticed 9 months ago, and has gradually become worse. Much swelling; knee flexed to right angle; fluctuation. Incision and drainage July 5; quantity of curdy thin pus. Erasion July 26, when acute symptoms had subsided. Large quantity of pulpy material removed; caseation in patches; cartilage perforated over outer condyle of tibia; sequestrum imbedded in caseous material removed from adjacent portion of bone; it extended through the epiphyseal line; cavity in bone scraped and touched with cautery. Discharge for some weeks. November 14, sent out in Paul splints and plaster; later has knee Thomas. Nov. 13, 1889, still wears Thomas, no discharge, joint apparently quite sound.

CASE 32.—*Erasion. Recovery.* Annie R., æt. 7½ years. Pulpy right knee; much pain and swelling. No improvement under rest, etc. Admitted July 3, 1888. Operation August 2. Joint cleared of diseased synovial membrane, cartilage eroded in spots; these with subjacent infiltrated bone gouged out. Crucial ligaments divided to get at disease behind. Drained. Healed by first intention, except small portion on outer side which discharged for some time. Left hospital September 26. Seen July 13, 1889; wears knee Thomas, joint quite sound and in good position, but no movement. (See fig. 8.)

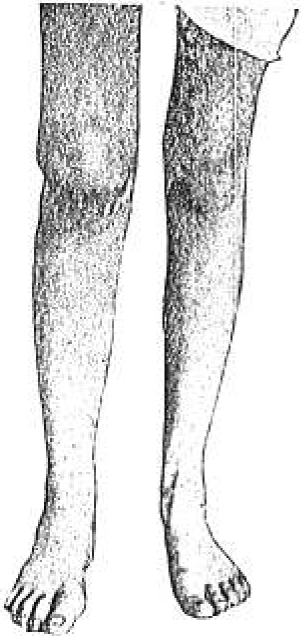


FIG. 8. RESULT OBTAINED IN CASE 32.

CASE 33.—*Erasion Recovery*. David C., æt. 12 years. Admitted October 18, 1887. Pulpy disease of right knee for last 5 years. No history of injury. Right hip anchylosed from old morbus coxæ. Much thickening of knee, which was semi-flexed. Sinus above external condyle of femur leading towards joint. Extension. Sent out January 11, 1888, in Thomas' splint. Readmitted July 27, 1888, as after some improvement knee became more swollen and painful. July 30, erasion. Curved incision below patella; some attempt at repair in interior, fibrous bands joining femur to patella; foci of caseation in synovial membrane, diseased portion of external condyle of femur removed, and corresponding point in patella.

Drained through popliteal space. No suppuration, rapidly healed. Put up in Paul splint and discharged September 26. Seen June, 1889. In good position and quite sound. Slight shortening, probably due to old morbus coxæ.

CASE 34.—*Erasion. Failure.* Frank M., æt. 8 years. Tubercular disease of right knee of long duration. Admitted July 27, 1888. Immense swelling of joint; subluxation; sinus leading into joint, with curdy discharge.

Operation August 2. Joint cleared of diseased synovial membrane; sequestrum removed from femur at epiphyseal line. Cautery to cavity in bone and to bleeding points. Drained through popliteal space. Considerable discharge which gradually lessened. Sent out July 27, in Paul splint. Child afterwards neglected at home, and living under worst possible hygienic surroundings. Seen July 13, 1889. Much thickening of joint over femur, two sinuses still discharging, will probably require amputation.

CASE 35.—*Erasion. Death from Scarlet Fever* John McH., æt. 5½ years. Admitted January 5, 1889, with pulpy disease of right knee of several months' duration; swelling, pain; flexed joint; no improvement with rest. Operation February 7. Incision across patella, which was divided; incision prolonged at its extremities upwards to expose upper pouch. Spots of caseation in diseased synovial membrane; membrane removed; anterior and part of posterior crucial ligaments removed as they were infiltrated. Disease had spread behind upper part of tibia along the sheath of the popliteus muscle. All disease carefully removed; patella sutured with catgut; incision stitched except at inner angle; no drainage tubes; wound was apparently healed by first intention, when on February 12, patient showed symptoms of scarlatina; was removed to fever ward, and died there.

CASE 36.—*Erasion. Recovery.* Florence P., æt. 1 year 7 months. Admitted to surgical ward June 5, 1889. Left knee noticed to be swollen 6 months before. Two weeks before joint was opened and a quantity of curdy pus escaped, drained across the joint. On examination, tubercular arthritis of left knee; slight amount of discharge from tubes. Operation June 21, erasion, transpatellar incision, all pulpy disease thoroughly removed; bone and cartilarge unaffected; track of sinuses cut away with scalpel. Surfaces from which diseased tissue removed touched with Paquelin's cautery. Patella sutured with catgut. Incision closed except about half an inch on each side, wound dressed and firmly bandaged before removing tourniquet. Put up in interrupted back splint. Dressed first time on July 2; wound healed by first intention, except the small surfaces left unstitched. July 8, put up in Paul splint and plaster-of-Paris. July 12, some swelling about knee from thigh plaster being too tight; plaster removed and limb put up again in back splint. July 8, all swelling gone and small raw surfaces nearly healed.

CASE 37.—*Erasion. Amputation.* Louisa Higgins,æt. 10 years. Disease of left knee following an injury 4 months before admission. Admission May 1, 1888. The limb was flexed in plaster of Paris, and she was sent home. On July 4, she was readmitted with knee worse and evidence of pulmonary tuberculosis. August 13, 1888, transpatellar erasion. There was a considerable quantity of pus in the joint, and one or two carious spots on the bones. The joint never became sound, and the limb was amputated in December, 1888.